

distribution of the primary nerves along the midribs. Again, in some species, the margins are more definitely serrulate or crenulate-serrulate than in others. Although the leaf-outline is highly variable, if one has an abundance of material there are certain definite trends which tend to mark a species; for instance, in *T. pomifera* (Roxb.) DC. there is a distinct tendency toward an elongated apex which is rarely found in our material of *T. sphaerocarpa* Hassk. We have not found the number of leaflets a dependable character, nor seen any strictly trifoliolate species. Our specimens are 1-3-5-foliolate or 5-7-11-foliolate. Craib, in describing *T. robusta*, points out that one leaf is 4-foliolate in the type-specimen. We have no material either of this species or of the related *T. trifoliata* Ridl. from the Malay Peninsula. The latter ought to be easy to recognize by the short panicle; as for the foliar characters of Ridley's species, it should be noted that in the original description, Jour. Roy. As. Soc. Straits Branch 82: 178. 1920, the petioles are described as ".2 in. long," which is repeated in Ridley's Fl. Malay Pen. 1: 512. 1922, but fig. 50 of the latter work shows them to be longer than any of the petiolules; the sketch is probably correct. The relative length of the panicle, its laxness, and the arrangement of the flowers, whether crowded or not, are fairly useful specific characters. The flowers are almost too constant to be of much help in determinative work. In some species the petals are ciliolate, some have larger anthers, a few have pubescent filaments, and the number of ovules varies, as from 2-4, 4-6, and 6-8. The size of the fruit would seem to be a fairly good character, but it is difficult to evaluate in the herbarium on account of the collections being in various stages of development. The thickness of the pericarp appears to be of some value, since, even in immature fruits of the fleshy-fruited species, this feature is foreshadowed by the relatively small locules in comparison with the thickness of the pericarp and the size of the fruit. Pubescence is a minor feature of *Turpinia* Vent. In two collections from Sumatra the leaflets are pubescent on the lower surface. *T. malabarica* Gamble, *T. ternata* Nakai, and sometimes *T. affinis* have pubescent or ciliolate filaments. *T. affinis* is the only species we have found with the style and the upper part of the ovary hirtellous.

Although the genus extends from China to New Guinea, several species have a limited distribution. The one with widest range, China, Indo-China, Sumatra, and Java, appears to be *Turpinia montana* (Blume) Kurz, with a variety in Borneo. *T. pomifera* (Roxb.) DC. has been considered a collective species extending from India to the Celebes, but our specimens indicate that *T. pomifera* (Roxb.) DC. in the strict

sense is found in northern India (including Assam and Burma), Siam, Indo-China, and western China. *Turpinia sphaerocarpa* occurs in Sumatra, Java, Borneo, Mindanao, and the Celebes.

Omitted from our summary is the consideration of *T. parviflora* Craib, *T. robusta* Craib, and *T. trifoliata* Ridl. We have no material so labelled, and none from the region of the type-localities that seems to fit their descriptions. Even when we have specimens to examine, the characters are sometimes so elusive that we cannot always be sure of the proper disposition of the collections. Our superficial key represents such species as are available to us in the herbarium material at hand. We are citing only what we take to be representative specimens, although in some cases we have numerous collections of individual species.

#### KEY TO SPECIES

1. Stipels separate. Indo-Malaysia.
  2. Pericarp somewhat fleshy, 1–5 mm. or more thick in the dried fruit.
    3. Fruit 2–2.5 cm. diameter; pericarp 2–5 mm. or more thick; half-open flowers 3.5–4 mm. long, anthers oblong-ovate, 0.8–1 mm. long; leaves oblong-elliptic, often elongate-acuminate  
..... *T. pomifera* (Roxb.) DC.
    3. Fruit up to 2 cm. diameter; pericarp 1–2(–3 in larger fruits) mm. thick; half-open flowers 2–3 mm. long, anthers  $\pm$  round, 0.6–0.8 mm. diameter; leaves oblong or elliptic, rarely elongate-acuminate.
      4. Filaments pubescent ..... *T. malabarica* Gamble.
      4. Filaments glabrous.
        5. Primary veins of leaflets 7–9, equally distributed along either side of the midrib; margins of leaflets distinctly crenulate-serrulate or serrulate.
          6. Leaves oblong, thinly coriaceous .....  
..... *T. sambucifolia* Elmer.
          6. Leaves elliptic or oblong-ovate, coriaceous .....  
..... *T. sphaerocarpa* Hassk.
        5. Primary veins of leaflets 4–6, gradually more remote toward the distal end of the leaflets; margins of leaflets usually indistinctly crenulate or serrulate.
          6. Inflorescence lax, loosely flowered; fruit depressed between the remnants of the subconic bases of the styles ..... *T. latifolia* Ridl.
          6. Inflorescence more compact and stiff; fruit  $\pm$  rounded or subtrilobed at the apex ... *T. ovalifolia* Elmer.
  2. Pericarp scarcely fleshy, 0.5–1 mm. thick, often wrinkled when dry.
    3. Half-open flowers relatively large, about 3 mm. long, anthers elliptic, 0.8–1 mm. long.
      4. Pistil glabrous.

- 5. Filaments glabrous; leaflets rather stiffly coriaceous, closely crenulate-serrulate; venation prominent; primary veins spreading, then arcuate, ascending for some distance almost parallel with the margin . . . .  
..... *T. nitida* M. & P.
- 5. Filaments pubescent; leaflets thinly coriaceous, remotely crenulate; venation not prominent; primary veins spreading-ascending, toward the margin arcuate . . .  
..... *T. ternata* Nakai.
- 4. Pistil, at least the style and exposed part of the ovary, sparsely hirtellous . . . . . *T. affinis* M. & P.
- 3. Half-open flowers relatively small, 2–2.5 mm. long, anthers  $\pm$  round, 0.5–0.6 mm. diameter or a little broader than long.
- 4. Inflorescence compact, somewhat stiff; flowers crowded.
- 5. Leaves coriaceous; secondary venation inconspicuous . . .  
..... *T. cochinchinensis* (Lour.) Merr.
- 5. Leaves chartaceous to subcoriaceous; secondary venation somewhat conspicuous . . . . . *T. glaberrima* Merr.
- 4. Inflorescence lax, usually longer than the leaves; flowers scarcely crowded.
- 5. Leaflets chartaceous; secondary venation easily seen . . . .  
..... *T. montana* (Bl.) Kurz.
- 5. Leaflets thinly coriaceous; secondary venation inconspicuous . . . . . *T. laxiflora* Ridl.
- 1. Stipels united into one intrapetiolar stipel and recurved toward the proximal end of the leaf. New Guinea.
- 2. Leaflets ovate-elliptic, rounded at the base, inconspicuously serrulate; fruit subglobose, marked at the apex with 3 radiating lines; ovules in each locule 6–8 . . . . . *T. Versteeghii* M. & P.
- 2. Leaflets mostly oblong, obtuse at the base, serrulate; fruits 3-pointed at the apex; ovules in each locule 2. . . *T. papuana* M. & P.

**Turpinia pomifera** (Roxb.) DC. Prodr. 2: 3. 1825.

*Dalrymplea pomifera* Roxb. Pl. Coromand. 3: 76, t. 279. 1819.

INDIA: Jalpaiguri, *Parker 3217*; Sikkim, *J. D. Hooker*, alt. 2–7000 ft.; Khasia, *Hooker f. & Thomson*, 2–5000 ft.; Assam, Margarata, *Dr. Prain's collector 986, 994*. BURMA: Moulmein, *Falconer*; Pegu, *Kurz 2050*; Mergui, *Parker 3083, 3172*. SIAM: Chiangmai Province, *Rock 1841, 1904*. INDO-CHINA: Tonkin, vicinity of Dong Mo, *Pételot 6320*. CHINA: Y u n n a n : Szemao, *Henry 11612F*; valley of the Nam Ha, *Rock 2490, 2505*; near Chieng Law, *Rock 2367*; Meng-bang, Jenn-yeh Hsien, *Wang 80302*; Tsang Yuan, *Wang 73219*; Che-li-Hsien, *Wang 75946, 77674, 77574, 79334*.

The strongest characters of this species appear to be the elliptic-

oblong acuminate leaflets (up to 23 cm. long and 8 cm. broad), the panicle usually shorter than the leaves, the fairly large flowers (half-open flower about 3.5–4 mm. diameter) crowded towards the tips of the ultimate branchlets, the ovate-oblong anthers 0.8–1 mm. long, and the fleshy fruits (in our dried specimens  $\pm$  2 cm. diameter). Roxburgh described the fruit as "the size of a large medlar." None of the other species of the genus in the herbarium material available to us has as fleshy fruits as this. Further, it can usually be distinguished, even if immature, by the small locules and the relatively thick pericarp.

**Turpinia malabarica** Gamble, Kew Bull. 1916: 135. 1916; Alston, Handb. Fl. Ceyl. 6(Suppl.): 59. 1931.

INDIA: Concan, *Stocks & Law*. CEYLON: *Thwaites* 218.

Our material of this species is not in very good condition; but apparently the two best characters of this species are the pubescent filaments and the size of the fruit (about 1.3 cm. diameter). The pericarp is a little fleshy, not nearly so thick as in *T. pomifera* DC., but thicker than that of *T. cochinchinensis* (Lour.) Merr.

**Turpinia sambucifolia** Elmer, Leaflet. Philip. Bot. 9: 3217. 1934.

PHILIPPINE ISLANDS: Luzon, *Elmer* 8750, 22178 (ISOTYPE); *Loher* 14941; *Merrill* 2502; *Williams* 551; *Vanoverbergh* 1088; *Forestry Bureau* 24951 (*Amarillas*), 29362 (*Azurin*); *Bureau of Science* 24252 (*Ramos*).

This species is very like *Turpinia sphaerocarpa* Hassk. The leaves are somewhat thinner in texture and oblong rather than elliptic. These are the only differences we see at present. Since we did not find any collection from Luzon exactly matching *T. sphaerocarpa* Hassk., we are maintaining the species for the present.

**Turpinia sphaerocarpa** Hassk. Flora 25: Beibl. 42. 1825.

*Dalrymplea javanica* Hassk. Pl. Jav. Rar. 439. 1848.

*Turpinia pomifera* sensu Koord. & Valetton, Meded. Lands Plant. 61: 245 (Bijdr. Boomsoort. Java 9: 245). 1903, Atlas Baumart. Java 1: fig. 93. 1913, non DC.

JAVA: *Forbes* 951, 965, 973; *Kuntze* 5909; *Netherlands Indies Forest Service* Ja.3076, Ja.3145, Ja.3734. SUMATRA: *Forbes* 2480, *W. N. & C. M. Bangham* 862, 981. BORNEO: Mount Kinabalu, *Clemens* 10407, 34388, 34423, 34462, 40321, 51675. PHILIPPINE ISLANDS: Mindanao, Province of Davao, *Elmer* 11726, 11825; Province of Surigao, *Forestry Bureau* 26983. CELEBES: *Netherlands Indies Forest Service* Cel./II-238.

We regret that we have not better material from Java representing

this species, as these are the logical collections to use as a basis of this specific concept. Only *Kuntze 5909* (a specimen borrowed from the New York Botanical Garden) has flower buds sufficiently well developed to show the parts of the flower fairly well; from this and *fig. 93* of Atlas Baumart. Java, we have taken the measurements for the anthers. In the Bornean material, particularly *Clemens 40321*, the apex of the anthers is much more distinctly apiculate; however, in view of the somewhat fragmentary material and the similarity in foliar characters, we have placed the Bornean collections in this species. *Clemens 40321* differs also in having somewhat narrower, almost ligulate, petals.

*Turpinia sphaerocarpa* Hassk. somewhat resembles *T. pomifera* (Roxb.) DC., but the leaflets as a whole are smaller, with finer crenulate-serrulate margins, and usually with a shorter apex (acumen up to 1.5 cm. long; unfortunately the tips of the leaflets are mutilated in many of our specimens; in *T. pomifera* DC. the acumen is 1–3 cm. long, usually about 2 cm.); the inflorescence is more ample, with less crowded and smaller flowers (half-open flower 2 mm. diameter), the anthers are rounded and only 0.5–0.6 mm. long, and the dried fruit rarely exceeds 1.5 cm. diameter.

***Turpinia latifolia*** Ridl. Jour. Roy. As. Soc. Straits Branch **82**: 178. 1920, Fl. Malay Pen. **1**: 512. 1922.

MALAY PENINSULA: Singapore, *Corner 34688*, *Ngadiman 34690*; Johore, *Corner 28690*, *28710*. SUMATRA: vicinity of Rantau Parapat, Bila, *Rahmat Si Toroës 1916*, *1924*, *2254*; Division Padang Si Dimpoean, *Rahmat Si Toroës 4808*, *4886*, *4921*.

This species, in the lax inflorescences, the size of the flowers, and the small anthers, is very like *Turpinia sphaerocarpa* Hassk. The leaflets, however, have a smaller number of primary veins, and these are obviously farther apart and unevenly distributed along the midrib, the interval between the adjacent pairs becoming longer toward the distal end of the leaflet; the margins too are only indistinctly crenulate-serrulate. The specimens from the Malay Peninsula are only in flower. In the Flora of the Malay Peninsula, l.c., Ridley described the fruit as "globose fleshy green .5 in. through." In the Sumatran collections, the apex of the fruit, even in some as large as 2 cm. diameter, is depressed between the remnants of the laterally compressed subconic bases of the styles.

***Turpinia latifolia*** Ridl. var. ***pubescens*** var. nov.

A forma typica differt ramulis, petiolo ac rhachi pubescentibus; foliis supra glabris, subtus praecipue costa nervisque pubescentibus; inflorescentiae axi, ramis ramulisque  $\pm$  pubescentibus.

SUMATRA: Sigamata, near Rantau Parapat, Bila, *Rahmat Si Toroës* 2922 (TYPE); Padang Si Dimpoean, Goenoeng Manaoen, *Rahmat Si Toroës* 4468.

The type is fragmentary, the leaflets being mostly separated from the rachis, but the flowers are normal. In the other specimen, the leaves are 3- and 5-foliolate, but all the flowers seem to have been stung. The general habit of the collections is much like that of *Turpinia latifolia* Ridl., hence, we have allied the material with that species. These are the only specimens of the genus in which we have seen pubescence on the leaves.

**Turpinia ovalifolia** Elmer, Leaf. Philip. Bot. 2: 490. 1908.

*Turpinia lucida* Nakai, Jour. Arnold Arb. 5: 80. 1924.

*Turpinia pachyphylla* Merr. Philip. Jour. Sci. 27: 33. 1925.

PHILIPPINE ISLANDS: Luzon, *Elmer* 8088 (isotype), 8601; *Bureau of Science* 22559 (*Ramos & Deroy*), 22585 (type of *T. lucida* Nakai), 40243 (*Ramos & Edaño*), 41483 (*Ramos*), 45283 (*Ramos & Edaño*); *Forestry Bureau* 22703 (*Gangan*), 24294 (*Bawan & Borromeo*); *Adduru* 273; Palawan, *Elmer* 13122.

This species and *Turpinia latifolia* Ridl., apart from their geographical range, are difficult to distinguish. In the Philippine material, the inflorescence is usually shorter than the leaves and also not so open as in *T. latifolia* Ridl., and the flowers are a little larger (half-open bud 3 mm. long) and of firmer texture than in the Malayan plant.

**Turpinia nitida** sp. nov.

Arbuscula glabra, tantum inflorescentia minute pubescens; petiolo  $\pm$  6 cm. longo, rhachi 10 cm. longa; foliis 1-2-jugis; foliolis valde coriaceis, oblongis vel ellipticis, 10-20 cm. longis, 4-9 cm. latis, basi rotundatis interdum leviter inaequalibus, apice breviter acuminatis, marginibus dense serratis, utrinque nitidis, manifeste reticulatis; venis primariis utrinsecus  $\pm$  10 patulis deinde arcuatim adscendentibus, versus marginem inconspicue vel haud anastomosantibus; petiolulis 1-3 cm. longis; paniculis 17 cm. longis, ramis 4 cm. longis atque ramulis puberulis; pedicellis  $\pm$  2 mm. longis; floribus sub anthesi 4.5 mm. diametro; sepalis 3-4 mm. longis late ellipticis rotundatis ciliatis; petalis oblongis 4 mm. longis vix ciliolatis; filamentis circiter 3.5 mm. longis, basi 0.8 mm. latis, apice subulatis, antheris ovatis circiter 1 mm. longis, apice apiculatis (apiculo 0.2 mm. longo); disco crenulato ovario glabro subaequilongo; stylis glabris  $\pm$  connatis; ovulis 4 in loculo; baccis immaturis  $\pm$  1 cm. diametro, stylorum basibus persistentibus; pericarpio 0.5 mm. crasso.

BORNEO: Mount Kinabalu, Penibukan, *Clemens* 30770 in part, 30840 (TYPE), January 1933, alt. 4000–5000 ft. (recumbent treelet; fruit purplish); Marai Parai, *Clemens* 30178, May 1933, alt. 3000 ft. (flowers cream-green, corolla purple on the margin).

This species is perhaps closest to *Turpinia sphaerocarpa* Hassk. The leaflets, however, are more regularly coriaceous than in the latter species, the flowers are somewhat larger with anthers almost 1 mm. long and very distinctly apiculate, and the fruits, with a pericarp 0.5 mm. thick, could scarcely be called fleshy.

***Turpinia ternata*** Nakai, Jour. Arnold Arb. 5: 78. 1924.

JAPAN: Liukiu, *Yokohama Nursery Company*; *C. Wright*; Kyushu, *Tashiro* (TYPE); *E. H. Wilson* 6107. FORMOSA: *E. H. Wilson* 11072.

In these collections the leaves are 1- and 3-foliolate. This is the nearest approach to a trifoliolate species in our herbarium. *Turpinia ternata* Nakai is a fairly well marked species with half-open flowers 3–4 mm. diameter, pubescent filaments and large ovate-oblong anthers 0.8 mm. long; the fruits are immature, but in these the pericarp is scarcely more than 0.5 mm. thick.

***Turpinia affinis*** sp. nov.

Arbor parva ubique praeter inflorescentiam glabra; cortice fusco; petiolo 6–14 cm. longo, rhachi 9–25 cm. longa; foliis impari-pinnatis 2–4 (interdum–5)-jugis; stipulis caducis, stipellis minutis; foliolis elliptico-oblongis, 7–18 cm. longis, 2.5–6 cm. latis, basi cuneatis vel obtusis, apice acuminatis (acumine 1–2.5 cm. longis), margine plerumque dense serratis, coriaceis, inconspicue reticulatis; venis primariis utrinsecus 7–10 arcuatim adscendentibus; petiolulis 1–1.5 cm. longis; paniculis usque 30 cm. longis, divaricatim ramosis, axi ramulisque minute pubescentibus; floribus in ramulis ultimis pseudoracemosis vel cymoso-confertis, magnis; pedicellis  $\pm$  1.5 mm. longis; sepalis elliptico-ovatis obtusis ciliatis 2.5–3 mm. longis; petalis 4 mm. longis obovato-ellipticis ciliatis, interdum paullo pilosis; filamentis 3 mm. longis, basi 1 mm. latis sursum angustatis, saepe ciliolatis, antheris ovato-oblongis 1 (–1.2) mm. longis; disco dentato  $\frac{1}{2}$  longitudinem ovarii; ovario 1 mm. longo, parte superiore atque stylis (2 mm. longis)  $\pm$  parce hirtellis; ovulis 6–8; baccis subglobosis, 1–1.5 cm. diametro, cicatricibus stylorum persistentibus, plerumque parce hirtellis; pericarpio 0.5–1 mm. crasso.

CHINA: Hupeh, *Chow* 2004; Kweichow, *Steward, Chiao & Cheo* 768; Kwangsi, *Steward & Cheo* 380; *Tsang* 22365, *Chun* 6817; Szechuan, *Wilson* 2351, 3359, 4803; *Fang* 3797, 12574; *Chiao & Fan*

136; *Yu-Shih Liu* 1283, 1885; Yunnan, *Tsai* 53322, 54334, 54598, 55334, 55982, 56614, 58519, 58667, 59122; *Yü* 17774, 19949; *Forrest* 15683 (TYPE), 17583, 18075, 26224, 26272; *Henry* 10694; Sikong, *Chiao* 1286, 1704. INDO-CHINA, Tonkin, Chapa, *Pételot* 5929.

Data on the type number, *Forrest* 15683, taken from Notes, Roy. Bot. Gard. Edinburgh 17: 152. 1930: "Shrub or tree of 30 or 40 ft. Flowers creamy-white. In open thickets on the Shweli-Salween divide. Lat. 25° 30' N. Alt. 10,000 ft. July 1917." This species has flowers as large as those of *Turpinia pomifera* (Roxb.) DC. The leaflets, although acuminate, have not the elongate apex which marks most of the collections of the latter species. The fruits are scarcely at all fleshy and not nearly so large as in *T. pomifera* (Roxb.) DC. Indeed, it would seem that this species is the explanation of why *T. pomifera* (Roxb.) DC. and *T. cochinchinensis* (Lour.) Merr. (*T. nepalensis* Wight & Arn.) have been confused in China. *Turpinia affinis*, although readily separated from *T. cochinchinensis* (Lour.) Merr. in the flowering state by the open lax inflorescence with flowers almost twice as large, is somewhat difficult to distinguish in the more nearly mature fruits. In all the specimens cited we have been able to see, around the subpersistent bases of the styles, some remnants of the pubescence which is readily seen on the pistil in the flower. The leaves usually have 5-9, sometimes 11, leaflets, a little broader than in the related species and more closely serrate.

***Turpinia cochinchinensis*** (Lour.) Merr. Jour. Arnold Arb. 19: 43. 1938.

*Triceros cochinchinensis* Lour. Fl. Cochinch. 184. 1790.

*Turpinia nepalensis* Wight & Arn. Prodr. 156. 1834.

INDIA: Nepal, *Wallich* 4277; Assam, Khasia, *Hooker f. & Thomson*; Khasia and Jaintia Hills, *Ruse* 137. BURMA: Thandaung, *Dickason* 5143; Kachin Hills, *Shaik Mokim*. INDO-CHINA: Annam, Mt. Bana, *Clemens* 3791; Tonkin, *Pételot* 4242. CHINA: Yunnan, *Henry* 11612, A, B, H, I; *Tsai* 54310, 54504, 54625, 56367, 56400, 56912, 58789, 58887, 58985; *Forrest* 7476, 8474, 11857, 11888, 15758, 17867, 17893, 26410, 26521; *Rock* 2924, 7200; *Wang* 73075, 76313, 77381; *Yü* 18195.

*Turpinia cochinchinensis* (Lour.) Merr. shows considerable variation. Amongst the material cited are specimens with 3-foliolate leaves, 3- and 5-foliolate leaves, but most have 5-foliolate leaves. The species is not an easy one to define. It blends into *T. montana* (Blume) Kurz and *T. glaberrima* Merr. on the one hand, and on the other it is not easy to distinguish from *T. affinis* in fruit. Its best character is the somewhat



stiff compact inflorescence and small flowers. In *T. montana* (Blume) Kurz the netted venation of the leaves is much more distinct, the serrations are closer, and the inflorescence is longer and distinctly lax.

***Turpinia glaberrima*** Merr. Lingnan Sci. Jour. 7: 312. 1931, l.c. 14: 27. 1935.

CHINA: Kwangsi, *Ko* 55847; Kwangtung, *Tsiang* 1701, 2715; *Taam* 176, 579; Hong Kong, *C. Wright*; Hainan, *How* 70303, 71654, 73218; *Wang* 36220, 36510; *Liang* 63626, 64285, 64286, 64719; *Chun & Tso* 43958, 43682, 43918, 44396; *McClure* (C.C.C. 8497). INDO-CHINA: along Kwangtung-Tonkin border, Taai Wong Mo Shan, *Tsang* 27226.

This species needs to be studied in the field; it is perplexingly inconstant. Some numbers have the leaves 1- and 3-foliolate, other 3- and 5-foliolate, or all 5-foliolate, a single number which we interpret as a young growing shoot of this species has 9-11-foliolate leaves. Some specimens are disturbingly close to *Turpinia montana* (Blume) Kurz, yet none has as long an inflorescence as that species; further, although the secondary venation is fairly distinct, the leaves are mostly firmer. Other collections are scarcely separable from *T. cochinchinensis* (Lour.) Merr. since we have removed *T. affinis* from that complex. Possibly more material of the three species will lead to the reduction of this.

***Turpinia glaberrima*** Merr. var. ***stenophylla*** var. nov.

A forma typica differt foliis angustioribus 4.5-6(-10) cm. longis, 1.5-2 cm. latis, plerumque rhachi brevioribus.

CHINA: Kwangtung, along the Kwangtung-Tonkin Border, Fang Ch'eng District, *Tsang* 26739 (TYPE); Kwangsi, Sup-man-ta Shan, *Liang* 69616, 69632.

These specimens are all fruiting material. The type of the variety has leaves small enough to belong to *Turpinia parviflora* Craib, described from Siam. We have no material so named, and Craib points out that it is very closely allied both to *T. parva* Koord. & Val. and to *T. nepalensis* Wight & Arn. Both the latter species have a fairly large inflorescence; the inflorescence in both *T. glaberrima* Merr. and var. *stenophylla* is mostly shorter than the leaves.

***Turpinia montana*** (Blume) Kurz, Jour. As. Soc. Bengal 46(2): 182. 1875; Koord. Exkursionfl. Java 2: 528. 1912; Koord. & Val. Atlas. Baumart. Java 1: fig. 92. 1913; Merr. Contr. Arnold Arb. 8: 93. 1934, Jour. Arnold Arb. 19: 42. 1938.

*Zanthoxylum montanum* Blume, Bijdr. 248. 1825.

*Turpinia parva* Koord. & Val. Meded. Lands Plant. 61: 249 (Bijdr. Boomsoort. Java 9: 249). 1903.

*Turpinia gracilis* Nakai, Jour. Arnold Arb. 5: 79. 1924. For further synonymy, consult Koorders (1912) and Merrill (1934).

CHINA: Yunnan, Szemao, *Henry* 12039, *b, c*; Fo-Hai, *Wang* 73601, 73694, 73813, 74654, 74797, 77154; Nan-Chiao, *Wang* 75050, 75136, 75181; Che-li Hsien, *Wang* 75497, 75693, 78111, 79504, 79713. INDO-CHINA: Tonkin, *Pételot* 5959; Annam, Mt. Bana, *Clemens* 3894; Cambodia, *Pierre* 907. SUMATRA: on trail from Kabajakan to Tretel, *W. N. & C. M. Bangham* 887. JAVA: *Hallier*; *Kuntze* 4498.

*Turpinia montana* (Blume) Kurz appears to be the most widely ranging species of the genus. It is a small tree with very slender and lax panicles as long as, or usually longer than, the leaves; the scarcely crowded flowers are small (half-open bud 2 mm. diameter) with ciliate petals and rounded anthers  $\pm$  0.5 mm. long; the fruit is 7-8 mm. diameter. The venation of the chartaceous leaves is perhaps more obvious than in any other known species.

***Turpinia montana* (Blume) Kurz var. *borneensis* var. nov.**

Foliolis usque 14 cm. longis et 5 cm. latis; fructibus usque 1.5 cm. diametro.

BORNEO: Sarawak, *Native collector* 2379; Mount Kinabalu, Penibukan, *Clemens* 31369, 31657, 40996, alt. 4000-8000 ft.; Tenompok, *Clemens* 28840, 29391 *bis* (TYPE), 29391, 30070, alt. 5000 ft.

The leaflets, although larger than in *Turpinia montana* (Blume) Kurz, somewhat broader and more rounded-cuneate at the base, are similar in texture and venation to those of the species. In the few inflorescences at our disposal we have not found any floral differences worth noting. The fruit is larger in some cases, but the seeds are few and the pericarp is thin. When more and better prepared material is at hand this may prove to be a distinct species.

***Turpinia laxiflora* Ridl. Jour. As. Soc. Straits Branch 82: 179. 1920, Fl. Malay Pen. 1: 512, 1922.**

MALAY PENINSULA: Perak, Larut, *Dr. King's collector* 5640 (Chanderiang). SUMATRA: Asahan, *Krukoff* 4425; *Rahmat Si Boeea* 6689, 6871, 6894, 7198; Simaloer, *Achmad* 559.

The distinguishing features of this species are the long lax panicles and the small (7-10 mm. diameter) dry fruits. In the specimens at hand all the dried fruits are wrinkled. This may be on account of their not

being mature, or because of the thin pericarp ( $\pm 0.5$  mm. thick). The leaves are very much like those of *Turpinia latifolia* Ridl.

***Turpinia Versteeghii* sp. nov.**

Arbor  $\pm 21$  m. alta glabra, tantum inflorescentia minute pubescens; petiolo 6–8 cm. longo, rhachi 5–8 cm. longa; stipulis caducis; foliis 1–3-jugis; stipellis in stipellam unam intrapetiolularem recurvatim connatis; foliolis coriaceis ovatis vel ellipticis, 9–17 cm. longis, 4.5–8.5 cm. latis, basi subrotundatis vel leviter cuneatis, apice breviter acuminatis, acumine  $\pm 1$  cm. longo, margine inconspicue serrulatis interdum revolutis, subnitidis; venis primariis utrinsecus 8, utrinque manifestis, patulis deinde curvatim adscendentibus; reticulo subobscuris; petiolulis 1–1.5 cm. longis, terminali 2–4 cm. longo; paniculis ad maturitatem 20–30 cm. longis, ramis subadscendentibus; floribus 3–4 mm. diametro; sepalis oblongis rotundatis ciliatis; petalis obovato-oblongis ciliatis; filamentis 2.5 mm. longis, basi 0.6–0.8 mm. latis, apice subulatis; antheris elliptico-ovatis 0.8 mm. longis minute apiculatis; disco dentato; ovario glabro; stylis glabris; ovulis in loculo 6–8; baccis obsolete trilobis 1.5 cm. diametro; pericarpio 2 mm. crasso.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass & Versteegh 13586* (TYPE), April 1939, alt. 300 m., frequent in primary rain-forest (tree 21 m. high, 39 cm. diameter; bark grey-brown, scaly, fissured; fruit green); 2 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 13532*, April 1939, alt. 700 m., frequent in primary rain-forest (tree 26 m. high, 50 cm. diameter; fruit green). NORTHEASTERN NEW GUINEA: Sattelberg, *Clemens 3089*, May 1936, alt.  $\pm 1000$  m. (flowers white).

The species is marked by the large and inconspicuously serrulate leaflets; the fruit lacks the protruding base of the styles so well marked in the other New Guinean species. Probably *Clemens 3358* and *4041* from Yunzaing also belong here. Both are fragmentary specimens.

***Turpinia papuana* sp. nov.**

Arbor  $\pm 20$  m. alta praeter inflorescentiam puberulam glabra; petiolo 3–6 cm. longo, rhachi 2–5 cm. longa; foliis 1–2-jugis (in una collectione 1–5-foliolatis); stipulis caducis; stipellis in stipellam unam intrapetiolularem recurvatim connatis; foliolis coriaceis oblongis vel ellipticis, 7–11(–15) cm. longis, 2.7–4(–7) cm. latis, basi obtusis, apice acuminatis, acumine 1–2 cm. longo, margine serrulatis; venis primariis utrinsecus circiter 8 patulo-adscendentibus, reticulo inconspicuo; inflorescentiis in fructu usque 18 cm. longis, juvenilibus ad nodos multibracteatis,

bracteis minute foliiformibus; baccis subglobosis vel subtrilobis, 1.5 cm. diametro, apice remote 3-tuberculatis; ovulis 1-2 in uno loculo; pericarpio 2-2.5 mm. crasso.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 11994* (TYPE), February 1939, alt. 2160 m., frequent tree of the primary forest, on the slope of a ridge (tree 20 m. high, 37 cm. diameter; bark grey; fruit green); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 11960*, January 1939, alt. 1750 m., occasional tree in primary forest, on ridge (tree 17 m. high, 36 cm. diameter; bark grey; fruits brown); Bele River, 18 km. northeast of Lake Habbema, *Brass & Versteegh 11143*, November 1938, alt.  $\pm$  2400 m., occasional in primary forest (tree 17 m. high; 33 cm. diameter; bark grey; fruits green-brown). NORTHEASTERN NEW GUINEA: Ogeramnang, *Clemens 6405*, May 1937, alt.  $\pm$  1750 m.

Although we are handicapped by the lack of flowers, this material seems to be relatively uniform, differing from *Turpinia Versteeghii* in the smaller leaves with less rounded bases and definitely serrulate margins. The fruits are 3-pointed at the apex and in each locule are only 1-2 ovules. In *T. Versteeghii* there are 6-8 ovules in each locule.

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THE COMPARATIVE MORPHOLOGY OF THE ICACINACEAE  
IV. RAYS OF THE SECONDARY XYLEM

I. W. BAILEY AND R. A. HOWARD

*With four plates*

INTRODUCTION

WE have shown in the preceding papers of this series that a segregation of the Icacinoideae into three categories, upon the basis of their nodal anatomy and vessel structure, serves to differentiate their imperforate tracheary elements and wood parenchyma into three general levels of increasing structural specialization. It is of interest in this connection to determine whether the salient trends of phylogenetic modification of the rays tend to parallel those that occur in the other elements of the secondary xylem.

Kribs' (6) statistical investigations of the wood of large stems indicate that the primitive ray structure in dicotyledons is of the so-called heterogeneous I type. Woods with this primitive structure are characterized by having two types of rays, (1) vertically extensive, high-celled, uniseriate rays and (2) multiseriate rays with relatively long, high-celled, uniseriate extensions. Barghoorn's (4) recent detailed studies of ray ontogeny in the various families of the dicotyledons demonstrate that in structurally less modified plants both the first-formed and the later-formed secondary xylem have rays of the heterogeneous I type. In young stems, the first-formed multiseriate rays extend outward from the gaps or interfascicular parts of the stele, whereas in young roots they arise opposite the strands of primary xylem rather than between them. The first-formed uniseriate rays of young stems extend outward from the fascicular parts of the stele.

The original uniseriate and multiseriate rays are very extensive vertically, but are dissected into lower rays during subsequent stages of the lateral enlargement of the stem. During these stages of ontogeny, the multiseriate rays commonly undergo a more or less conspicuous increase in width, due either to an increase in the size or the number of